



**City of Santa Clara  
Building Inspection Division**

1500 Warburton Avenue  
Santa Clara, CA 95050  
Phone: (408) 615-2440  
Fax: (408) 241-3823  
<http://www.ci.santa-clara.ca.us>

**RESIDENTIAL ELECTRICAL REQUIREMENTS**

October 15, 2004



# Residential Electrical Requirements (Based on NEC 1999)

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## ROUGH ELECTRICAL

Panel Boards

Service Requirements

Receptacle Outlets

Kitchen Outlets

ARC-Fault and Ground-Fault Protection

City of Santa Clara  
Building Inspection Division  
1500 Warburton Ave.  
Santa Clara, CA 95050  
(408) 615-2440 – Inspection Division  
(408) 615-2420 – Permit Center

## GENERAL ELECTRICAL REQUIREMENTS FOR DWELLINGS

### GENERAL LIGHTING AND RECEPTACLE LOADS

Building Area \_\_\_\_\_ Square feet x 3 volt-amps per sq. ft. = \_\_\_\_\_ VA

TOTAL AMPERAGE REQUIRED FOR GENERAL LIGHTING AND RECEPTACLES: \_\_\_\_\_

NUMBER OF AMPERES = \_\_\_\_\_ VA ÷ 120 VOLTS = \_\_\_\_\_ AMPERES

NUMBER OF CIRCUITS = \_\_\_\_\_ AMPERES ÷ 15 OR 20 AMPERS = \_\_\_\_\_ .....CIRCUITS

### **MINIMUM NUMBER OF CIRCUITS REQUIRED:**

ONE 15 AMP. Circuit for general lighting and receptacles for every 600 sf of floor area or every 10 receptacles.

ONE 20 AMP. Circuit for general lighting and receptacles for every 800 sf of floor area or every 13 receptacles.

TWO 20 AMP. Circuits per Sec. 220-4(b) for small appliance circuits for each 1500 VA (or 1500 watts, per Sec. 220-16(a) to serve all receptacle outlets, including refrigeration equipment, in the kitchen, pantry, breakfast room, dining room, or similar area.

ONE 15 AMP. Laundry circuit for each 1500 va (or 1500 watts, per Sec. 220-16(b).

### **LOCATION (HEIGHT) OF RECEPTACLES:**

Place receptacles at 15 inches minimum from finished floor to center of receptacle.

### **HORIZONTAL SPACING OF RECEPTACLES:** Sec. 210-52:

In bedrooms, living rooms, den, parlor, sun room, recreation rooms and similar rooms or space, no point along the floor line in any wall space (2ft or more wide) OR fixed room dividers (such as bars) shall be more than 6 ft from an outlet in that space.

In kitchen : see kitchen circuits requirements

In bathrooms : at least one wall receptacle outlet adjacent to each basin location.

At outdoors : at least one at front and back of each dwelling unit.

In laundry areas : at least one per area.

### **ARC FAULT CIRCUIT INTERRUPTER IN BEDROOMS:** Sec. 210-12.

### **GROUND FAULT INTERRUPTION PROTECTION REQUIREMENTS:** Sec. 210-8.

Provide GFCI for accessible receptacles installed in bathrooms, garages, outdoors within 6'-6" above grade or access level, crawl spaces in unfinished (not habitable) basements, in wet areas within 6 ft of a sink in a bathroom, kitchen, wet bar or similar situations.

### **LIGHTING SWITCHES FOR REQUIRED OUTLETS:** Sec. 210-70

Provide at least one wall-switch-controlled lighting outlet in all habitable rooms, bathrooms, hallways, stairways, attached and detached garages with electric power, and at outdoor entrances and exits (vehicle doors are not considered as entrances or exits), at point of entry to the attic, underfloor space, utility room, basement used for storage or equipment servicing, at equipment to be serviced, (three-way switch) at interior stairways (one at each floor level.)

### MINIMUM CONDUCTOR SIZES FOR GENERAL WIRING PER NATIONAL ELECTRICAL CODE TABLE 310-5.

VOLTAGE RATING OF CONDUCTOR IN VOLTS

Min. conductor size – per AWG (American Wire Gauge)

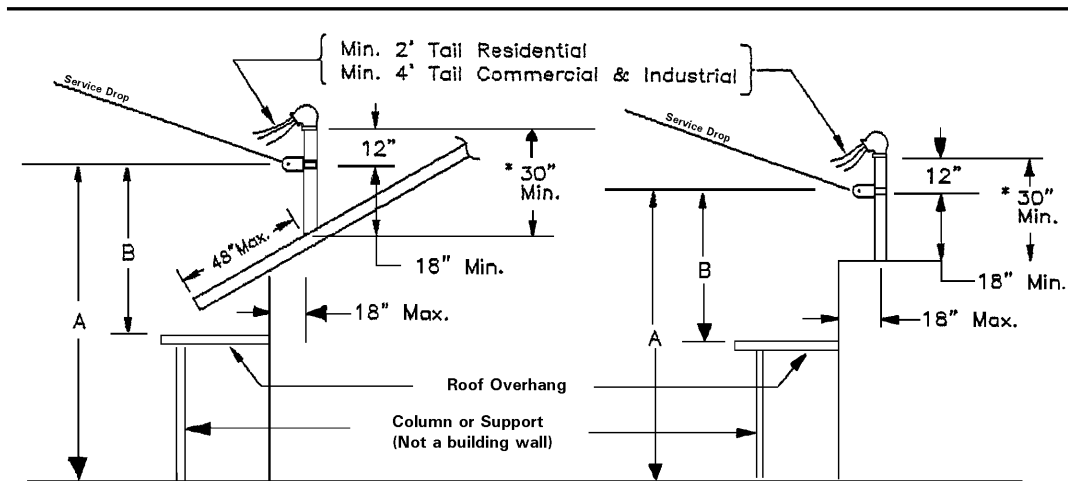
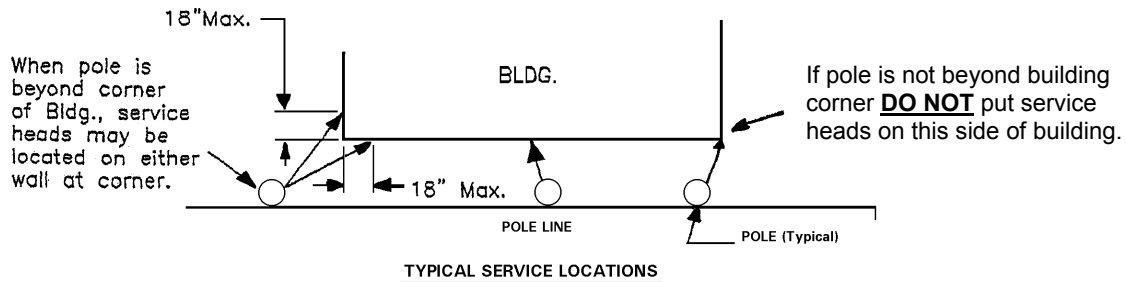
0 THROUGH 2000 VOLTS

14 GA. FOR COPPER  
12 GA. FOR ALUMINUM OR COPPER CLAD ALUMINUM

2001 THROUGH 5000 VOLTS

8 GA.

## RESIDENTIAL ELECTRIC OVERHEAD SERVICE REQUIREMENTS



### RESIDENTIAL DIMENSIONS:

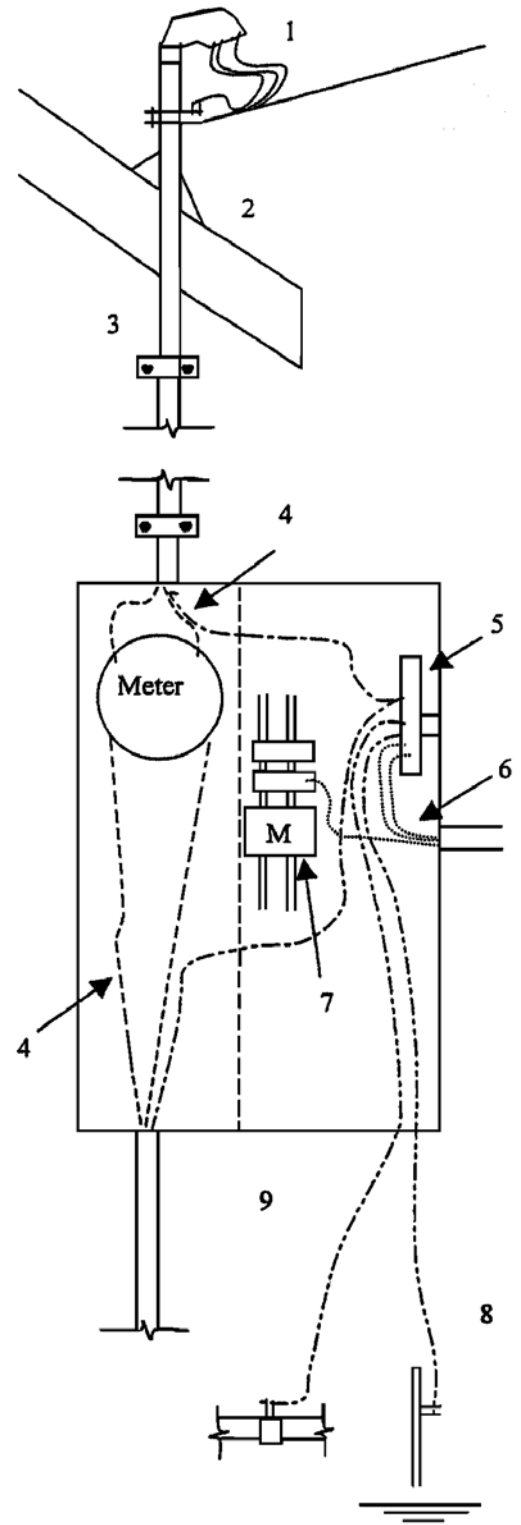
**'A' Dimension =** 12' – 0" Min. over driveway  
10' – 0" Min. over pedestrian – only area

**'B' Dimension =** 8' – 0" Min. over walkable roof  
2' – 0" Min. over non-walkable & non-metallic roof

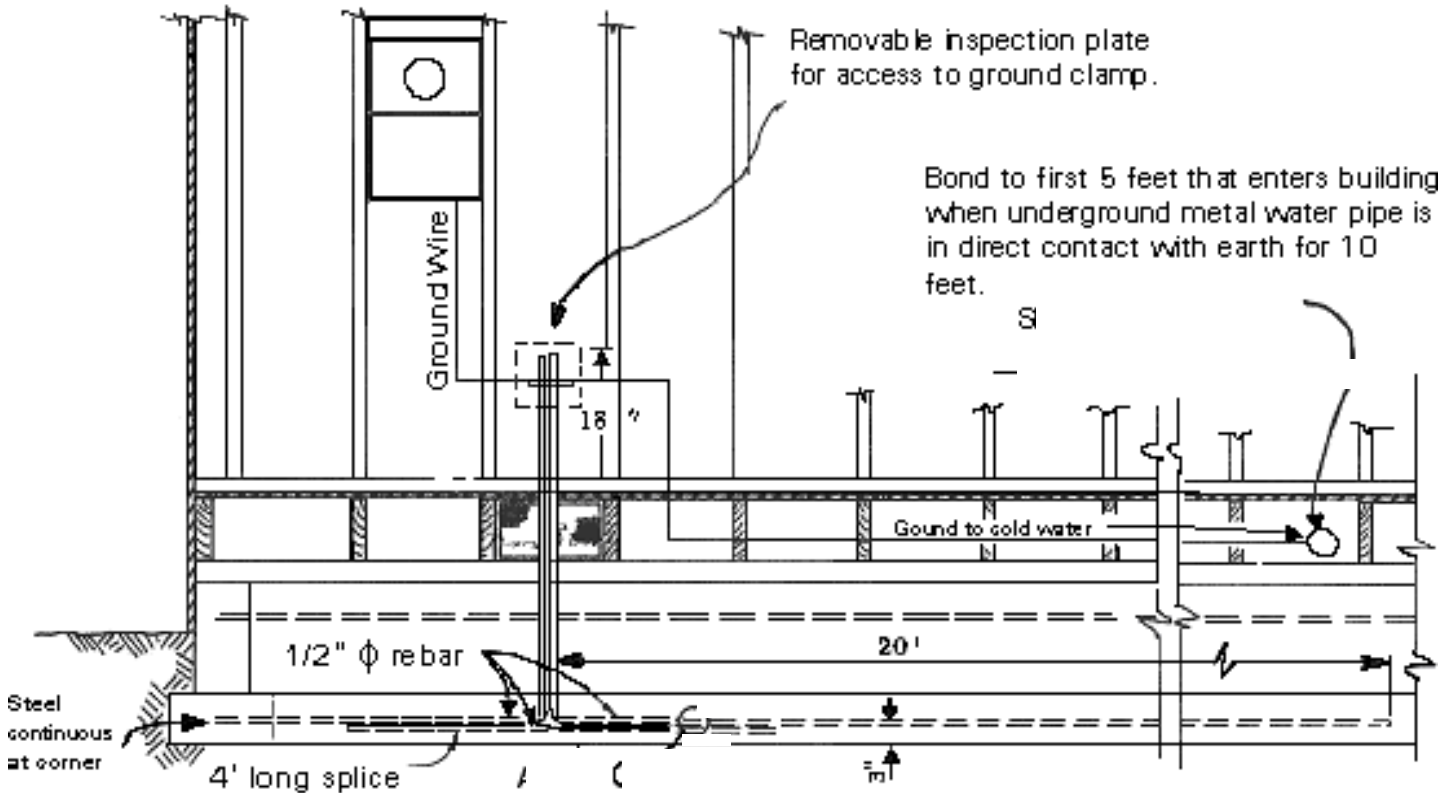
1. Service mast(s) shall be a minimum of 1-1/4 inch rigid steel conduit (no couplings.)
2. Service mast(s) must be a minimum of 30" above roof line (no couplings.)
3. Service mast(s) must be braced if length exceeds 36". Service mast(s) height without bracing shall be limited to 30 inches above the roof in locations where the service drop must be installed through trees, or where trees or the tree branches may strike or cause unplanned loading on the service drop.
4. Service mast(s) must be braced with a two-hole pipe strap nearest to 30" under eave or side fascia.
5. Service mast(s) projecting above roofs or eaves shall be continuous without couplings from point of attachment of the utility service drop to below the roof or eave.
6. Service mast(s) penetrations through wood roofs or wood sheathing must have flashing.
7. Service drop shall be attached to a periscope mast(s) on the roof not more than 18" back of that wall, if practical.
8. You must provide a minimum of two (2) feet of conductor out of your weatherhead for proper drip loop and neutral conductor must be identified with white tape.
9. Service will not be attached directly to metal roofs. Service drop cable shall clear metal roofs by a minimum distance of eight (8) feet.
10. For a service disconnect of your service conductors, an inspection and request for disconnect must be arranged 24 hours in advance with the Building Inspection Division 615-2400. Disconnects are made by Santa Clara Electric Department between 8:00 A.M. to 9:00 A.M. and reconnects between 2:00 P.M. and 3:00 P.M. that same day. No disconnects are provided on Mondays. OWNER or CONTRACTOR must be present to have service disconnected.

# Residential Electric Meter Installation Standard

1. Weather Head	Weather head sized in accordance with riser size. Conductors passing over the overhang only may be a minimum of 18 inches above the overhang. Conductors passing over the roof must be 3 feet above surface if the roof is 4 in 12 pitch or greater. Eight foot clearance is required for roof pitch of under 4 in 12. Ten foot clearance is required at ground level and 12 foot over driveways.
2. Flashing	Flashing must be installed on all roof penetrations.
3. Riser and riser attachment to building.	Riser length is minimum 5 feet. Riser size must be: 1-1/4 inch min. for up to #1 copper conductor. 1-1/2 inch min. for up to #2/0 copper conductor. Riser must be securely supported within 12 inches of the plate line and 12 inches of the service panel using 1/4 lag or toggle bolts.
4. Service Entrance Conductors. Overhead & Underground installations shown.	For overhead service drops, a min. 12 foot clearance above grade level is required. Required size of Service entrance conductors (and recommended size for neutral): #4 copper for 100 Amp service. #1 copper for 150 Amp service. 2/0 copper for 200 Amp service.
5. Neutral Bus bar	Neutral bus bar must be grounded to the service panel. Neutral service entrance conductor, neutral circuit conductors, grounding electrode conductor, and ground conductors must be attached to the neutral bus bar.
6. Circuit conductors	Circuit shall have hot conductor protected by circuit breaker sized as follows: #14 conductor – 15 amp breaker #12 conductor – 20 amp breaker #10 conductor – 30 Amp Breaker #8 conductor – 40 amp breaker If terminating in the main service panel both the neutral and ground conductor shall attached to the neutral bus bar. If terminating in a sub-panel the neutral and ground shall terminate at separate neutral and ground bus bars.
7. Main Disconnect	A main is required for more than six breakers.
8. Grounding Electrode & electrode conductor	Electrode systems shall consist of all available electrodes including "UFER", cold water, and other electrodes listed in the 2000 NEC Sections 250-52 & 250-50. Conductor size to be as per NEC 250-66, exceptions are important in determining minimum sizing. Electrode conductors smaller than #6 or where subject to physical damage must be protected by conduit. When metal conduit is used it shall be bonded to the electrode at both the bottom and top.
9. Water Pipe Bond	A water pipe bond wire must be provided and sized as a grounding electrode conductor. The bond wire shall terminate at the neutral bus.



## CONCRETE ENCASED GROUNDING ELECTRODE



Grounding of service systems shall be by means of an approved concrete encased grounding electrode (uferground) installed within the building foundation. An electrode encased by at least 2 inches of concrete, located within and near the bottom of a concrete foundation or footing that is in direct contact with the earth consisting of at least 20 feet of one or more steel reinforcing bars or rods of not less than 1/2 inch diameter, or consisting of at least 20 feet of bare copper conductor not smaller than No. 4 AWG. An eighteen (18) inch terminal of each rod or one rod shall be exposed at service equipment location from a point above mudsill to top of rod or rods to provide connection to grounding conductor; and all interior metallic water piping shall be bonded to grounding electrode by an unbroken grounding conductor sized as per N.E.C. 250-66 for service ground. All interior metal piping, which may become energized, shall be grounded by one or more means and sized in accordance with Table 250-122 using the rating of the circuit which may energize the piping. All points of attachment of the bonding jumper shall be accessible.

(FPN) Two or more electrodes that are effectively bonded together are to be treated as a single electrode system in this sense.

**Note:** Consult with Inspection Division for any alterations or unusual conditions.

## Kitchen Lighting

The Standards have mandatory measures that address: **voltage**

Kitchen Lighting  
Bathroom Lighting  
Recessed Lighting



1. Luminaires for general lighting in kitchens shall have lamps with an efficacy of not less than 40 lumens per watt. General lighting must provide a sufficient light level for basic kitchen tasks and provide a uniform pattern of illumination. A luminaire(s) that is (are) the only lighting in a kitchen will be considered general lighting. General lighting shall be controlled by a switch on a readily accessible lighting control panel at an entrance to the kitchen.

Additional luminaires to be used only for specific decorative effects need not meet this requirement.

2. Luminaires installed to meet the 40 lumens per watt requirements shall not contain medium base incandescent lamp sockets, and shall be on separate switches from any incandescent lighting.

Installing energy-efficient lamps and fixtures can reduce lighting energy costs without sacrificing the quality or quantity of light available. The intent of the kitchen lighting code is not to increase the number of light fixtures and/or watts used by the occupant but rather to ensure that the builder provides - and the occupant uses - energy efficient lighting. A 40-watt (Full-Size, 4' long) standard fluorescent lamp is over four times as efficient (in terms of efficacy) as a 100-watt standard incandescent lamp of the Standards as, "...the ratio of light from a lamp to the electrical power consumed (including ballast losses) expressed in lumens per watt").

The general lighting in kitchens must:

- Have an efficacy of at least 40 lumens/watt.
- Provide a uniform pattern of lighting, such as a fixture in the center of the kitchen or around the perimeter (not a fixture in the corner).
- Provide a light level sufficient for performing basic kitchen tasks such as preparing meals and washing dishes.
- Be controlled on a readily accessible switch at an entrance to the kitchen (not in a cupboard or beside the kitchen sink).
- Be switched independent of incandescent lighting.
- Shall not contain medium-base incandescent lamp sockets. This prevents the occupant from replacing the efficient light source with an incandescent lamp.

If there is only one light in the kitchen, it is general lighting.

Additional luminaires for decorative effect do not need to meet these requirements, however, incandescent lighting fixtures recessed into insulated ceilings must be approved for zero-clearance insulation cover (IC-rated).

To clearly demonstrate compliance with the Standards to a building department, a lighting layout design that includes a point-by-point illuminance grid for the high-efficacy lighting may be provided. To do this properly, this grid must account for the room geometry, fixture placement, photometric data for the fixtures, lamp lumens, lamp lumen depreciation, and reflectivity of all of the surfaces in the kitchen.

## Bathroom Lighting

Each room containing a shower or bathtub shall have at least one luminaire with lamp(s) with an efficacy of 40 lumens per watt or greater. If there is more than one luminaire in the room, the high efficacy luminaire shall be switched at an entrance to the room.

ALTERNATIVE: A high efficacy luminaire need not be installed in a bathroom if:

- A. A luminaire with lamps with an efficacy of 40 lumens per watt or greater is installed in a utility room, laundry room, or garage; and Residential Manual
- B. All luminaires permanently mounted to the residence providing outdoor lighting shall be installed with the following characteristics:
  - (1) Luminaires with lamps with 40 lumens per watt or greater; or
  - (2) Luminaires with lamps with an efficacy of less than 40 lumens per watt shall be equipped with a motion sensor.

**Note:** When using this alternative for multiple bathrooms, after complying with B. for the first bathroom, each additional bathroom in which a high efficacy luminaire is not installed must comply with A. alone.

- 3. Luminaires installed to meet the 40 lumens per watt shall not contain medium base incandescent lamp sockets, and shall be on separate switches from any incandescent lighting.

Each room with a shower or bathtub must have at least one luminaire with lamps with an efficacy of at least 40 lumens/watt. If there is more than one luminaire in the room, the high-efficacy luminaire must be switched at an entrance to the room.

As an alternative, both of the following are required:

- 1. A luminaire with 40 lumens/watt lamps must be installed in another room with utilitarian functions such as a laundry room, utility room or garage; and
- 2. All permanently mounted outside lighting must either be at least 40 lumens/watt or equipped with a motion sensor.

Luminaires installed to meet the 40 lumens/watt requirements cannot contain medium base incandescent lamp sockets, and must be on separate switches from incandescent lighting.

Incandescent lighting fixtures recessed into insulated ceilings must be approved for zero clearance insulation cover (IC-rated) in compliance with the code.

Installing energy-efficient lamps and fixtures can reduce lighting energy costs without sacrificing the quality or quantity of light available. A 40 watt standard fluorescent lamp is over four times as efficient as a 100 watt standard incandescent lamp.

## Recessed Lighting

All incandescent lighting fixtures recessed into insulated ceilings shall be approved for zero-clearance insulation cover (i.c.) by Underwriters Laboratories or other testing/rating laboratories recognized by the International Conference of Building Officials.



All incandescent lighting fixtures recessed into insulated ceilings must be approved for zero-clearance insulation cover (IC-rated). Although this requirement does not apply to fluorescent fixtures, recessed lighting fixtures left uninsulated significantly increase the heat loss through the roof/ceiling area reducing the effectiveness of the insulation. Heat lamps are not required to be IC-rated.



Inspection Division  
1500 Warburton Avenue  
Santa Clara, CA 95050

**Building a better community"**

Phone: 408-615-2440  
Permit Center: 408-615-2420  
Fax: 408-241-3823  
Email: [buildinginspection@ci.santa-clara](mailto:buildinginspection@ci.santa-clara).

The Building Inspection Division has served the community for more than sixty years. The Building Inspection Division's mission is to protect the public health and safety by assuring that all installations and construction methods meet state and local codes. By being well informed of these codes and requirements you can assist in assuring a safer environment for you and your family.